



AF
JW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

EDWARD J. FIORE

Serial No.: 09/688,717

Filed: October 16, 2000

For: Arbitrated Loop Port Switching

Attorney Docket No.: 98-046-NSC (STK98046PUS)

Group Art Unit: 2665

Examiner: Man U. Phan

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
U.S. Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief from the final rejection of claims 1, 8, 10, 12-20 and 23-32 of the final Office Action mailed on October 22, 2004, for the above-identified patent application.

06/24/2005 TBESHAH1 00000012 09688717

01 FC:1402

500.00 OP

I. REAL PARTY IN INTEREST

The real party in interest is Storage Technology Corporation, a corporation organized and existing under the laws of the state of Delaware, and having a place of business at One StorageTek Drive, MS-4309, Louisville, Colorado, 80028-4309, as indicated in the "Proprietary Rights Agreement" signed by the inventor, Edward Fiore, attached as Exhibit A to the Petition Under 37 C.F.R. § 1.47(b) filed in this case May 8, 2001, and granted on or

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8

I hereby certify that this paper, including all enclosures referred to herein, is being deposited with the United States Postal Service as first-class mail, postage pre-paid, in an envelope addressed to: Mail Stop Appeal Brief - Patents, Commissioner for Patents, U.S. Patent & Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 on:

June 21, 2005
Date of Deposit

Mark D. Chuey, Ph.D.
Name of Person Signing


Signature

before July 18, 2001.

II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to the Appellant, the Appellant's legal representative, or the Assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-36 are pending in this application. Claims 1, 8, 10, 12-20 and 23-32 have been rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

No amendment after final rejection was filed in this case.

V. SUMMARY OF CLAIMED SUBJECT MATTER

In typical loop networks, bandwidth must be shared by devices interconnected by the loop. An example is an arbitrated Fibre Channel loop through which only two of the devices may communicate at one time. The present invention eliminates problems with traditional loops by connecting nodes, such as controllers and drives, onto a separate or private communication loop so that the group of nodes accesses the full bandwidth of the private communication loop.

With reference to Figures 3-5, a method of interconnecting a plurality of nodes according to Appellant's invention includes forming a main communication loop (80) interconnecting the plurality of nodes (C1-C3, D1-D5). A request is received from a first node

(C1) to access a second node (D1). If the second node is not busy, a separate communication loop (82) *including only the first node and the second node* is formed. The separate communication loop is formed to leave the nodes not including the first node and the second node interconnected by the main communication loop.

As illustrated in Figure 1, Appellants' invention may be embodied in a hub (11) interconnecting a plurality of nodes (30a-30n). Each node has a channel (32a-32n, 34a-34n) over which data is transmitted and received. Each node communicates with a port interface (12a-12n). Each port sends data over a send data path (34a-34n) and receives data over a receive data path (32a-32n). An interconnect device (20), in communication with each port interface, forwards data between any send data path and any receive data path. A controller (26), in communication with each port interface and the interconnect device, signals the interconnect device to form a plurality of separate communication loops. Each separate communication loop (*e.g.*, loops 82 and 84 of Figure 9) includes only requesting nodes (*e.g.*, C1 on loop 82 and C2 on loop 84 of Figure 9) and nodes responding to the requesting nodes (*e.g.*, D1 on loop 82 and D2 on loop 84 of Figure 9).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner based his rejections upon the following art:

1. U.S. Patent No. 5,751,715 to Chan *et al.* (henceforth, Chan),
2. U.S. Patent No. 5,619,497 to Gallagher *et al.* (henceforth, Gallagher), and
3. U.S. Patent No. 6,614,796 to Black *et al.* (henceforth, Black).

In a final Office Action dated October 22, 2004, the Examiner rejected claims 24-32 under 35 U.S.C. § 103(a) as being unpatentable over Chan in view of Gallagher. The Examiner rejected claims 1-8, 10, 12-20 and 23 under 35 U.S.C. § 103(a) as being unpatentable over Chan in view of Gallagher and Black.

VII. ARGUMENT

Appellant believes claims 1, 8, 10, 12-20 and 23-32 are patentable over any combination of the cited art as explained in the following arguments.

A. **Claims 24-32 Are Patentable Under 35 U.S.C. § 103(a) Over Chan and Gallagher**

Independent claim 24 provides a hub interconnecting a plurality of nodes, each node having a channel over which data is transmitted and received. The hub includes a port interface for each node, an interconnect device and a controller. Each port interface sends data over a send data path and receives data over a receive data path. The interconnect device forwards data between any send data path and any receive data path. The controller signals the interconnect device to form a plurality of separate communication loops, *each separate communication loop including only requesting nodes and nodes responding to the requesting nodes*.

Claim 24 is patentable over any combination of Chan and Gallagher because neither reference teaches or fairly suggests forming separate communication loops each including only requesting nodes and nodes responding to the requesting nodes.

Chan discloses breaking a large Fibre Channel loop into subloops, each containing many devices. If a requesting node on one subloop is granted access to a responding device on another subloop, the subloops are connected together by a hub, as disclosed in the Abstract (emphasis added).

An apparatus for accelerated Fiber Channel protocol handshaking and data exchange involves dividing a Fiber Channel arbitrated loop architecture up into a **plurality of arbitrated subloops, each of which arbitrates locally using the same fundamentals as the Fiber Channel arbitration protocol but with some slight modifications which do not affect the compatibility of standard Fiber Channel nodes**. Each subloop is coupled to a hub port which contains a state machine which does switching function and fill word generation to implement the accelerated protocol by using a plurality of switching, fill word generation and token passing rules. The

state machine in each hub port is coupled to its local subloop and to its neighboring hub ports through a single TDMA bus which has timeslots dedicated to carrying broadcast loop and return loop traffic and control token traffic. In some embodiments, the hub ports are coupled to their neighboring hub ports by separate broadcast and return loops and a control loop used for token passing. The accelerated Fiber Channel Arbitrated Loop protocol is carried out by the distributed intelligence of state machines in each hub port which achieve acceleration in a Fiber Channel protocol by performing the following steps: **allowing simultaneous local arbitration in all subloops**; notifying the local arbitration winner on a subloop coupled to a hub port when an ARB token arrives at that hub port; broadcasting an OPN primitive to all hub ports and subloops to start the process of finding the subloop upon which the destination node is located; **identifying the subloop upon which the destination node is found**; **establishing switching connections to connect the subloop on which the source node is found to the subloop on which the destination node is found and bypassing all subloops upon which neither the source nor destination node is found**; completing a data transfer from the source node to the destination node and closing the connection between the source node subloop and the destination node subloop.

Chan discloses *a priori* placement of a plurality of devices on each subloop—before any request is made. Thus, arbitration on each subloop must occur before the subloops are interconnected. Chan neither teaches nor fairly suggests forming separate communication loops each including only requesting nodes and nodes responding to the requesting nodes.

Gallagher discloses a method for reordering frames of a packet received at a port out of order. Gallagher discloses that the invention may be adapted to a standard Fibre Channel loop system as described in column 20, lines 17-39, as follows:

A Fibre Channel Arbitrated Loop specification (FC-AL) Rev. 4.34 X3T11 Project 960D dated Sep. 18, 1994, which is incorporated herein by reference, describes both switch fabric and arbitrated loop configurations. In an arbitrated loop configuration, nodes are daisy-chain connected to form a loop, with the transmitter circuitry of one node connected to the receiver circuitry of another. Nodes connected in an arbitrated loop configuration arbitrate for access to the loop by passing

arbitration primitives around loop. Once a node obtains access to the loop, thereby becoming a source node, a destination node is “opened” and the transmission between the source node and destination node becomes a point to point transmission, with intermediate nodes positioned between the source and destination nodes on the loop passing data through to the next port on the loop.

The arbitrated loop circuit 344₁-344_N associated with each port 304₁-304_N is operable to pass frames through the respective port 304₁-304_N when an arbitrated loop topology is utilized and the respective port 304₁-304_N is an intermediate port on the loop. For example, when port 304₁ is an intermediate port in an arbitrated loop configuration, the arbitrated loop circuit 344₁ passes received frames through, for transmission to the next port on the loop.

Gallagher neither teaches nor fairly suggests forming separate communication loops each including only requesting nodes and nodes responding to the requesting nodes.

The Examiner’s arguments that the cited art discloses Appellant’s invention are without merit. Paragraph 3 of the final Office Action appears to be an attempt by the Examiner to rebut Appellant’s argument that Chan does not disclose a separate communication loop for the first and second nodes. The Examiner begins by apparently admitting that Applicants are correct at page 2 as follows (emphasis in the original):

Applicant’s argument with respect to the rejected claim 1 [is] that the cited references do not each or suggest the “*forming a separate loop containing only those nodes necessary to support the requested communication*”. However, Chan et al. (US#5,751,715) is applied herein merely for the teaching of the accelerated Fiber Channel protocol handshaking and data exchange involves dividing a Fiber Channel arbitrated loop architecture up into a plurality of arbitrated subloops.

If Chan “is applied merely for the teaching” of a plurality of arbitrated subloops, which reference actually discloses Appellant’s separate loops? The Examiner does not say.

The Examiner next refers to Chan’s Figure 5, which is a “prior art” representation of “a protocol flow of a typical Fibre Channel local area network.” (Col. 5, ll. 25-27.) As is well known in the art, Fibre Channel arbitrated loops of this kind include

many devices interconnected in a ring. This ring is discovered upon initialization and, barring failure of a device or insertion or removal of a device, is not changed during operation. There is no possibility of forming separate communication loops as provided in Appellant's invention. The Examiner states that "a source node and a destination node can acquire the loop for their exclusive use in a data transfer operation." This may be true, but this is not forming a *separate loop*. The other devices are still in the loop and, in fact, all data flows through the ports on these devices.

The Examiner's next attempt appears to be that Chan's Figure 8a discloses Appellant's separate loops. Figure 8a is described in Chan at col. 7, ln. 32-col. 8, ln. 3, reproduced as follows;

Referring to FIG. 8, there is shown a block diagram of an improved accelerated Arbitrated Loop Fibre Channel protocol network. The network has been broken down into four subloops in accordance with the teachings of the invention. Subloop "A" is comprised of three nodes designated A1, A2 and A3. Each one of these nodes can be a unit such as a disk drive, server, etc. Likewise, the three other subloops have three nodes also. For example subloop "B" has nodes B1, B2 and B3 and likewise for subloops "C" and "D". Each of these subloops is coupled to a hub port. The four hub ports are labeled A, B, C and D and are coupled to the subloop having the same letter designation.

The function of these hub ports is to implement an accelerated protocol for operating the Fibre Channel protocol network. This accelerated protocol is consistent with the Fibre Channel protocol in that all the same commands and primitives are used for purposes of arbitration to take control of the network and setting up and closing data transfer connections. However, the accelerated protocol implemented by the structure of FIG. 8 is improved in that each data transfer from a source node to a destination node is implemented through switching in the hub ports such that many of the nodes in the network which would otherwise be involved in the transfer in a prior art Fibre Channel network are essentially "cut out of the loop". Since each node that a data frame passes through in a Fibre Channel network imposes a six word delay (called a latency time) with each word being forty bits long, each node that is cut out of the loop in a data transfer with the accelerated protocol results in a

saving in overall loop latency time. This means that the data in a transfer operation arrives at the destination sooner and the destination can send back a CLS (close) or RRDY (ready to send data) command sooner to request more data or close the connection. By virtue of the data transfer happening more quickly, the Fibre Channel network is released more quickly for another data transfer transaction. Therefore, the entire I/O transfer rate of the network increases substantially.

Chan discloses placing devices on subloops *a priori*, before any specific requests are known. Only those subloops containing the requestor and the responder are then connected together. There will, however, still be devices on this reduced loop which are neither the requestor nor the responder. Chan neither teaches nor suggests Appellant's invention as claimed.

The Examiner's final attempt appears to be a reference to the FC-AL specification. Again, as well known in the art, this specification calls out a loop containing many devices that is established on initialization and which cannot form separate loops as provided by Appellant's invention.

Claim 24 is patentable over any combination of Chan and Gallagher. Claims 25-27, which depend from claim 28, are therefore also patentable.

1. **Claim 28 Is Separately Patentable Under
35 U.S.C. § 103(a) Over Chan and Gallagher**

Independent claim 28 provides a method of interconnecting a plurality of nodes. A communication loop interconnecting the plurality of nodes is formed. A request is received from a first node to access a second node. A determination is made as to whether or not the second node is busy. If the second node is not busy, *a separate communication loop is formed including only the first node and the second node*. The separate communication loop is formed to *leave the plurality of nodes not including the first node and the second node interconnected by the main communication loop*.

Claim 28 is patentable over any combination of Chan and Gallagher because neither reference teaches or fairly suggests forming a separate communication loop including only the requesting first node and the requested second node. In addition, neither Chan nor

Gallagher teach or fairly suggest first forming a loop interconnecting all nodes and leaving all nodes not including the first node and the second node interconnected by the main communication loop after the separate communication loop is formed.

The Examiner rejected claim 28 by simply stating it was a “method claim corresponding to” claim 24 and was therefore “analyzed and rejected as previously discussed” for claim 24. Even a casual read of claims 24 and 28 indicates that one is not simply a method version of the other. The Examiner found no teaching or suggestion, in either Chan or Gallagher, for Appellant’s first forming a loop interconnecting all nodes and then leaving all nodes except the first node and the second node (connected by the separate communication loop) interconnected by the main communication loop after the separate communication loop is formed.

Even if claim 24 is not patentable, claim 28 is patentable over any combination of Chan and Gallagher. Claims 29-32, which depend from claim 28, are therefore also patentable.

**B. Claims 1-8, 10, 12-20 and 23 Are Patentable Under
35 U.S.C. § 103(a) Over Chan, Gallagher and Black**

Claim 13 provides a switching hub for use in a network having a plurality of nodes each connected to the switching hub by a sending channel and a receiving channel. Each node sends at least one connection message. The switching hub includes an interconnect switch, a plurality of port interfaces and a controller. The interconnect switch connects the sending channel and the receiving channel of each node into at least one separate communication loop. Each port interface links the respective receiving channel and the respective sending channel of its respective node to the interconnect switch and detects messages on the receiving channel. *The controller forms a plurality of separate communication loops, each separate communication loop based on at least one detected message. Each separate communication loop consists only of at least one requesting node and at least one node responding to the at least one requesting node.*

The Examiner rejected claim 13 as an obvious combination of Chan, Gallagher and Black, although the Examiner failed to indicate what teaching was lacking in Chan and Gallagher that was provided by Black. As described above, neither Chan nor Gallagher teach or fairly suggest separate communication loops consisting only of requesting nodes and nodes responding to the requesting nodes.

Nor does Black provide the missing disclosure. As illustrated in Figure 1 of Black, reproduced below, Black discloses interconnecting Fibre Channel Loops.

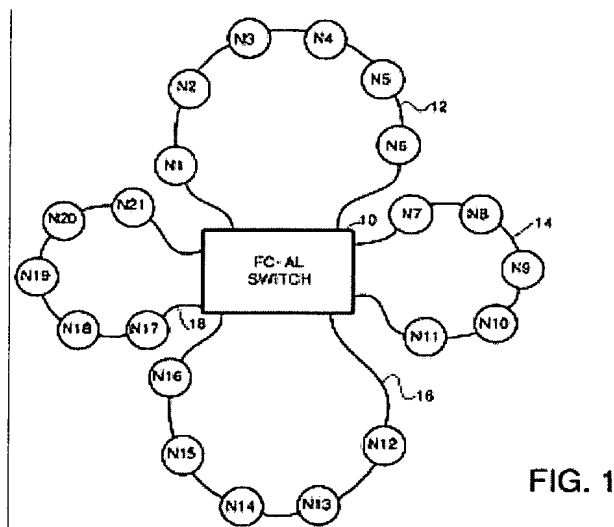


FIG. 1

Black discloses Fibre Channel loops that are established *a priori*, and not by any controller. The controller cannot separate communication loop consisting only of at least one requesting node and at least one node responding to the at least one requesting node.

Referring to FIG. 1, there is shown one embodiment of a switched FCAL architecture. FCAL switch 10 is coupled to four FCAL networks (hereafter sometimes referred to as FCAL nets) 12, 14, 16 and 18 in this example. Each FCAL net can have one or more NL nodes thereon. Each of the four FCAL networks is coupled to a plurality of NL nodes which have conventional structure and which can carry out FCAL arbitration, data transfer and flow control operations on the FCAL networks. Each node is assigned an address from one of the 127 possible FCAL addresses.

Black, column 12, lines 7-16.

Black, like Chan¹, interconnects existing Fibre Channel loops. Moreover, each loop has devices which will be neither a requesting node nor a node responding to the requesting node.

No combination of Black, Chan or Gallagher teach or fairly suggest Appellant's controller forming a plurality of separate communication loops each consisting only of at least one requesting node and at least one node responding to the at least one requesting node. Claim 13 is patentable over Black, Chan and Gallagher. Claims 14-23, which depend from claim 13, are therefore also patentable.

**1. Claim 1 Is Separately Patentable Under
35 U.S.C. § 103(a) Over Black, Chan and Gallagher**

Claim 1 provides a method for controlling a plurality of message transfer operations between a plurality of nodes. A request from a first node *to switch the first node to a separate communication loop* is detected, *the separate communication loop containing only the first node*. The first node is switched to the separate communication loop. A request from the first node to open message transfer operation between the first node and a second node is detected. The second node is switched to the separate communication loop when the second node is not busy.

The Examiner rejected claim 1 as a method claim "corresponding to the apparatus" claim 13. The Examiner made no attempt at finding disclosure, in Black, Chan or Gallagher, for detecting a request from a first node to switch the first node to a separate communication loop and switching the first node to the separate communication loop containing only the first node. None of the references teach or fairly suggest Appellant's forming a separate communication loop containing only the first node.

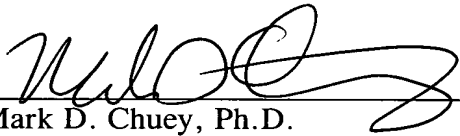
Claim 1 is patentable over any combination of Black, Chan or Gallagher. Claims 2-12, which depend from claim 1, are therefore also patentable.

¹Kurt Chan and Alistair Black are named inventors on both the Chan and the Black patents.

The fee of \$500 as applicable under the provisions of 37 C.F.R. § 41.20(b)(2) is enclosed. Also enclosed is a fee of \$120 for a one month extension of time under 37 C.F.R. § 1.17(a). Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 02-3978.

Respectfully submitted,

EDWARD J. FIORE

By: 
Mark D. Chuey, Ph.D.
Registration No. 42,415
Attorney/Agent for Applicant

Date: June 21, 2005

BROOKS KUSHMAN P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075-1238
Phone: 248-358-4400
Fax: 248-358-3351

Enclosure - Appendices



VIII. CLAIMS APPENDIX

Claims 1-36 are pending in this application.

1 1. A method for controlling a plurality of message transfer
2 operations between a plurality of nodes, the method comprises:
3 detecting a request from a first node to switch the first node to a
4 separate communication loop, the separate communication loop containing only the
5 first node;
6 switching the first node to the separate communication loop;
7 detecting a request from the first node to open message transfer
8 operation between the first node and a second node; and
9 switching the second node to the separate communication loop when
10 the second node is not busy.

1 2. The method of claim 1 wherein all of the nodes are switched
2 to form a main communication loop upon initialization.

1 3. The method of claim 1 wherein upon initialization all of the
2 nodes have a status of not busy, the method further comprising setting the status of
3 the first node and the second node to busy after the second node is switched to the
4 separate communication loop.

1 4. The method of claim 1 further comprising facilitating message
2 transfer operation between the first node and second node on the separate
3 communication loop.

1 5. The method of claim 1 further comprising:
2 closing message transfer operation;
3 setting the status of the first node and the second node to not busy after
4 closing message transfer operation;
5 switching the first node out of the separate communication loop; and
6 switching the second node out of the separate communication loop.

1 6. The method of claim 5 further comprising waiting for a
2 predetermined amount of time after at least one of setting the status of the first node
3 to not busy and setting the status of the second node to not busy before switching the
4 first node and the second node out of the separate communication loop.

1 7. The method of claim 1 further comprising:
2 acknowledging to the first node the request to open message transfer
3 operation after detecting a request from the first node to open message transfer
4 operation;

5 notifying the first node that the second node is busy in response to the
6 status of the second node being busy; and
7 notifying the second node of the request to open message transfer
8 operation after switching the second node to the separate communication loop.

1 8. The method of claim 1 further comprising:
2 detecting a request from a third node to open a second message
3 transfer operation between the third node and the second node; and
4 switching the third node to the separate communication loop.

1 9. The method of claim 8 further comprising:
2 acknowledging to the third node the request to open the second
3 message transfer operation after detecting the request from the third node to open a
4 second message transfer operation;
5 notifying the third node that the second node is busy in response to the
6 status of the second node being busy; and
7 notifying the second node of the request to open the second message
8 transfer operation after switching the third node to the separate communication loop.

1 10. The method of claim 1 further comprising:

2 detecting a request from the first node to open a third message transfer
3 operation between the first node and a fourth node; and
4 switching the fourth node to the separate communication loop.

1 11. The method of claim 10 further comprising:
2 acknowledging to the first node the request to open the third message
3 transfer operation after detecting the request from the first node to open the third
4 message transfer operation;
5 notifying the first node that the fourth node is busy if the status of the
6 fourth node is busy; and
7 notifying the fourth node of the request to open the third message
8 transfer operation after switching the fourth node to the separate communication loop.

1 12. The method of claim 1 wherein the network is a Fibre Channel
2 arbitrated loop network.

1 13. A switching hub for use in a network having a plurality of
2 nodes each connected to the switching hub by a sending channel and a receiving
3 channel, each node sending at least one connection message, the switching hub
4 comprising:

5 an interconnect switch for connecting the sending channel and the
6 receiving channel of each node into at least one separate communication loop;
7 a plurality of port interfaces, each port interface linking the respective
8 receiving channel and the respective sending channel of each node to the interconnect
9 switch, each port interface detecting messages on the receiving channel; and
10 a controller in communication with the plurality of port interfaces and
11 the interconnect switch, the controller operative to form a plurality of separate
12 communication loops, each separate communication loop based on at least one
13 detected message, each separate communication loop consisting only of at least one
14 requesting node and at least one node responding to the at least one requesting node.

1 14. The switching hub of claim 13 wherein the plurality of nodes
2 communicate with each other using a protocol having a plurality of messages and
3 defining message types of at least Arbitration having at least a source addresses,
4 Open having at least a source address and a destination address, and Close.

1 15. The switching hub of claim 13 wherein the plurality of nodes
2 are switched to form a main communication loop upon initialization.

1 16. The switching hub of claim 13 wherein the message types
2 include Busy and Idle.

1 17. The switching hub of claim 13 wherein the controller is further
2 responsive to a predetermined time-out period before releasing each node from the
3 at least one separate communication loop.

1 18. The switching hub of claim 13 wherein the controller forms a
2 separate communication loop connecting only a first node and a second node, the first
3 node requesting access to the second node.

1 19. The switching hub of claim 18 wherein the controller forms the
2 separate communication loop connecting a third node requested by the first node.

1 20. The switching hub of claim 18 wherein the controller forms the
2 separate communication loop connecting a fourth node requesting access to the
3 second node.

1 21. The switching hub of 13 wherein each port interface comprises:
2 a receiver connected to the sending channel of one node of the plurality
3 of nodes;

4 a decoder linking the receiver to the interconnect switch, the decoder
5 in communication with the controller, the decoder detecting messages sent to the port
6 interface;
7 a transmitter connected to the receiving channel of one node of the
8 plurality of nodes; and
9 a multiplexer linking the transmitter to the interconnect switch, the
10 multiplexer in communication with the controller.

1 22. The switching hub of 13 wherein the controller comprises:
2 a busy port store for identifying the status of the plurality of nodes;
3 a valid arbitration loop address store for storing messages; and
4 a processor in communication with the encoder, the multiplexer of
5 each port interface, the busy port store, and the valid arbitration loop store, the
6 processor interpreting connection messages.

1 23. The switching hub of 13 wherein at least one node utilizes a
2 Fibre Channel protocol.

1 24. A hub interconnecting a plurality of nodes, each node having
2 a channel over which data is transmitted and received, the hub comprising:

3 a port interface in communication with each node through the channel,
4 each port sending data over a send data path and receiving data over a receive data
5 path;

6 an interconnect device in communication with each port interface, the
7 interconnect device operative to forward data between any send data path and any
8 receive data path; and

9 a controller in communication with each port interface and the
10 interconnect device, the controller operative to signal the interconnect device to form
11 a plurality of separate communication loops, each separate communication loop
12 including only requesting nodes and nodes responding to the requesting nodes.

1 25. A hub as in claim 24 wherein the controller forms each separate
2 communication loop based on a message received from at least one port included in
3 the separate communication loop.

1 26. A hub as in claim 24 wherein each port interface generates the
2 message based on signals received from at least one port in a Fibre Channel protocol.

1 27. A hub as in claim 24 wherein the controller establishes every
2 port in one loop upon initialization.

1 28. A method of interconnecting a plurality of nodes comprising:
2 forming a main communication loop interconnecting the plurality of
3 nodes;
4 receiving a request from a first node to access a second node;
5 determining if the second node is not busy; and
6 if the second node is not busy, forming a separate communication loop
7 comprising only the first node and the second node, the separate communication loop
8 formed to leave the plurality of nodes not including the first node and the second
9 node interconnected by the main communication loop.

1 29. A method of interconnecting a plurality of nodes as in claim 28
2 further comprising:
3 receiving a request from the first node to access a third node;
4 determining that the third node is not busy; and
5 if the third node is not busy, joining the third node in the separate loop
6 comprising the first node and the second node.

1 30. A method of interconnecting a plurality of nodes as in claim 28
2 wherein the received request conforms to a Fibre Channel protocol.

1 31. A method of interconnecting a plurality of nodes as in claim 28
2 further comprising interconnecting each node in the main communication loop upon
3 initialization.

1 32. A method of interconnecting a plurality of nodes as in claim 28
2 wherein the second node is detached from a second loop before forming the separate
3 communication loop.

1 33. A method for controlling a plurality of message transfer
2 operations between a plurality of nodes, the method comprises:
3 detecting a request from a first node to switch the first node to a
4 separate communication loop;
5 switching the first node to the separate communication loop;
6 detecting a request from the first node to open message transfer
7 operation between the first node and a second node;
8 switching the second node to the separate communication loop when
9 the second node is not busy;
10 detecting a request from a third node to open a second message
11 transfer operation between the third node and the second node;
12 switching the third node to the separate communication loop;

1 acknowledging to the third node the request to open the second
2 message transfer operation after detecting the request from the third node to open a
3 second message transfer operation;
4 notifying the third node that the second node is busy in response to the
5 status of the second node being busy; and
6 notifying the second node of the request to open the second message
7 transfer operation after switching the third node to the separate communication loop.

1 34. A method for controlling a plurality of message transfer
2 operations between a plurality of nodes, the method comprises:
3 detecting a request from a first node to switch the first node to a
4 separate communication loop;
5 switching the first node to the separate communication loop;
6 detecting a request from the first node to open message transfer
7 operation between the first node and a second node;
8 switching the second node to the separate communication loop when
9 the second node is not busy;
10 detecting a request from the first node to open a third message transfer
11 operation between the first node and a fourth node;
12 switching the fourth node to the separate communication loop;

1 acknowledging to the first node the request to open the third message
2 transfer operation after detecting the request from the first node to open the third
3 message transfer operation;
4 notifying the first node that the fourth node is busy if the status of the
5 fourth node is busy; and
6 notifying the fourth node of the request to open the third message
7 transfer operation after switching the fourth node to the separate communication loop.

1 35. A switching hub for use in a network having a plurality of
2 nodes each connected to the switching hub by a sending channel and a receiving
3 channel, each node sending at least one connection message, the switching hub
4 comprising:
5 an interconnect switch for connecting the sending channel and the
6 receiving channel of each node into at least one separate communication loop;
7 a plurality of port interfaces, each port interface linking the respective
8 receiving channel and the respective sending channel of each node to the interconnect
9 switch, each port interface detecting messages on the receiving channel;
10 a controller in communication with the plurality of port interfaces and
11 the interconnect switch, the controller controlling the interconnect switch to form at
12 least one separate communication loop based on at least one detected message;

13 a receiver connected to the sending channel of one node of the plurality
14 of nodes;
15 a decoder linking the receiver to the interconnect switch, the decoder
16 in communication with the controller, the decoder detecting messages sent to the port
17 interface;
18 a transmitter connected to the receiving channel of one node of the
19 plurality of nodes; and
20 a multiplexer linking the transmitter to the interconnect switch, the
21 multiplexer in communication with the controller.

1 36. A switching hub for use in a network having a plurality of
2 nodes each connected to the switching hub by a sending channel and a receiving
3 channel, each node sending at least one connection message, the switching hub
4 comprising:
5 an interconnect switch for connecting the sending channel and the
6 receiving channel of each node into at least one separate communication loop;
7 a plurality of port interfaces, each port interface linking the respective
8 receiving channel and the respective sending channel of each node to the interconnect
9 switch, each port interface detecting messages on the receiving channel; and

10 a controller in communication with the plurality of port interfaces and
11 the interconnect switch, the controller controlling the interconnect switch to form at
12 least one separate communication loop based on at least one detected message;
13 a busy port store for identifying the status of the plurality of nodes;
14 a valid arbitration loop address store for storing messages; and
15 a processor in communication with the encoder, the multiplexer of
16 each port interface, the busy port store, and the valid arbitration loop store, the
17 processor interpreting connection messages.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.